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Sarah Lichtenstein and Baruch Fischhoff

Sponsored by
OFFICE OF NAVAL RESEARCH
under Contract N00014-80-C-0150

to
PERCEPTRONICS, INC

DECISION RESEARCH
A Branch of Perceptronics
1201 Oak Street
Eugene, Oregon 97401

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Two groups of subjects assessed their confidence in the accuracy of their answers to 200 general-knowledge two-alternative items. One group was given short instructions and the other lengthy instructions. The appropriateness of their confidence, called calibration, proved to be unrelated to both length of instruction and subjects' gender. All but five of the 71 subjects were at least somewhat overconfident; only six could be described as "pretty well calibrated."

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SUMMARY

Overview

One way that people can express their confidence in the accuracy of their own knowledge is to use probabilities (e.g., the probability that event A will occur--or that intelligence report B is true--is .75). One measure of the adequacy of probability assessments is called calibration. A set of probability assessments are well calibrated if, in the long run, the proportion of events that occur or statements that are true is equal to the assessed probability. Thus, for example, your assessments of .75 are well calibrated if just 75% of the events in question occur. The research project under which the present paper was written has as its goal to explore the psychology of confidence as expressed via probabilities.

Background

A large research literature exists on the calibration of probabilities. However, most of the research has employed naive participants who have received only very brief instructions concerning probability. The present report compares the calibration of participants given only the usual brief instructions with the calibration of those who were presented with lengthy instructions that more fully explained probability and calibration. In addition, the present report explores one possible cultural source of differences in confidence, gender. If it is true that males in our culture are socialized to be confident whereas females are trained to be modest, or even deprecatory, about their abilities, one might expect that females would be less confident when assessing probabilities.

Approach

The task was to decide, for each of 200 general-knowledge questions, which of two possible answers was correct (e.g., "The spleen's function is to filter [a] blood, [b] lymph") and to assess the probability that the chosen answer was indeed the correct one. About half of the 34 male and 37 female subjects were given short instructions; the others were given long instructions.

Findings and Implications

There was no effect on calibration or confidence due to instructions. This finding is consistent with previous research suggesting that overconfidence is more related to cognitive difficulties than to unfamiliarity with the response scale.

In addition, males and females did not differ with respect to calibration or confidence.

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THE EFFECTS OF GENDER AND INSTRUCTIONS

Suppose you were asked, "Which is longer, the Suez Canal or the Panama Canal?", and further requested to assess the probability that your chosen answer is correct. Such assessments express your confidence in your own knowledge. A burgeoning research area (reviewed in Lichtenstein, Fischhoff & Phillips, in press) deals with the appropriateness, or calibration, of such expressions of confidence. Probabilities are well calibrated if, over the long run, one is correct XX% of the times that one attaches a probability of .XX to an answer.

The overwhelming finding of this research is that, with questions of moderate difficulty, probability assessors are usually overconfident. For example, they are typically correct on only 75% of the occasions that they assign a probability of .9. Such overconfidence is usually interpreted as evidence that people exaggerate the accuracy of their knowledge. An alternative explanation is that people simply do not understand the probabilistic response scale. Most laboratory research documenting overconfidence has used quite brief explanations of that scale; seldom has calibration (the criterion on which subjects' performance is evaluated) been explicitly described. The present research compares the calibration of people given such short instructions with the calibration of people given lengthier instructions including an explicit explanation of calibration.

The longer instructions are similar to those used in a calibration training study (Lichtenstein & Fischhoff, 1980). In that study, we were surprised to find that one third of our subjects appeared to be well calibrated prior to any training.

Although we suspected that this prowess reflected something unusual about these particular subjects (who had been recruited by personal contact), it could have been due to the more extensive instructions used.

We also explore in the present study the possibility that males and females differ in their degree of overconfidence. The popular wisdom of today is that in our culture males are socialized to be confident whereas females are trained to be modest, or even deprecatory, about their abilities. If this is the case, then females might show less confidence than equally knowledgeable males. The result would be lessened overconfidence and improved calibration.

Method

Subjects

The subjects were 34 males and 37 females who answered an ad in the University of Oregon student newspaper. The present task was one of two paper-and-pencil judgment tasks performed in group settings lasting an hour and a half. Subjects were paid for their participation.

Items

The items were 200 general-knowledge questions with two alternative answers (e.g., "Tricolor is the name of the: A. Swiss national flag; B. French national flag;" "The spleen's function is to filter: A. Blood; B. Lymph"). These items had been used before, as the first set of computer-presented training items, by Lichtenstein and Fischhoff (1980).

Design

One group of subjects (14 males and 19 females) received the short instructions; the other group (20 males and 18 females) received long instructions. The instructions were given in typed form and read aloud by the experimenter. Subjects then proceeded at their own pace. For each item they first chose the correct answer and then indicated the probability (.5 to 1.0) that their choice was correct.

Instructions

The short instructions were the same as we have used in other calibration research (e.g., Lichtenstein & Fischhoff, 1977). They read, in full:

> This task is composed of 200 items. Each item is a brief phrase followed by two alternatives, labeled A and B. Only one of the alternatives is correct. Read each item and the two alternatives carefully. First, decide which alternative you think is correct, and mark your answer on the answer sheet. Please indicate an answer, either A or B, even when you are completely unsure which is correct. Then in the space provided to the right of your answer place a probability value indicating how sure you are that your answer is correct. This probability can be any number from .5 to 1.0. It can be interpreted as your degree of certainty about the correctness of your answer. For example, if you respond that the probability is .60, it means that you believe that there are about 6 chances out of 10 that your answer is correct. A response of 1.00 means that you are absolutely certain that your answer is

correct. A response of .50 means that your best guess is as likely to be right as wrong. Don't estimate any probability below .50, because you should always be picking the alternative that you think is more likely to be correct. Write your probability in the space provided on the answer sheet.

To repeat, this probability is a measure of your degree of certainty that your chosen alternative is the correct alternative. It is a number from .5 to 1.0 where .5 means complete uncertainty and 1.0 means complete certainty.

Don't worry if you don't know the answers to some items. We're not so much interested in how much you know as we are interested in how well you can express your own feelings of knowing or not knowing in the probability response.

The long instructions were three single-spaced typewritten pages. In addition to the points made in the short instructions, the long instructions included:

> . . . The more certain you are that you are right, the larger the number you should choose. But what number should you choose? This is the nub of the problem. We are asking you to do a very difficult task. We want you to examine your own "gut feelings" of certainty and uncertainty and translate those feelings into a probability number.

A paragraph explaining why the probability response must be equal to or greater than .5 ended with:

> . . . So a probability of less than .5 suggests that you goofed the first step, by not choosing the alternative which is most likely correct.

A paragraph explaining that one could use any number of digits, like .703 or .832319, noted:

> . . . but you will find out very soon that you are not capable of making subtle discriminations such as deciding whether to give a .703 or a .704. You probably won't <u>want</u> to use numbers with a lot of fancy extra digits. . . . And how do you decide whether to say .6 or .7? You have to review all the information you have in your head about the item in question, and gauge how confident you are about the correctness of your choice.

The remainder of the instructions discussed calibration. The subjects were told their goal was:

> . . . to translate your own internal feelings of certainty, uncertainty, and partial certainty into the precise language of probability numbers. We want you to be well calibrated in the same sense that a thermometer is well calibrated. When a calibrated instrument says 32°F, it means the same thing every time, and it means something very specific: the temperature at which water freezes.
>
> Likewise, you should mean the same thing every time you say .5. That means (a) I'm completely uncertain between the two possible answers and (b) on average, I have a 50% chance of getting this one right.

The responses of two hypothetical subjects were presented in the instructions. The experimenter amplified the written instructions at this point, explaining in detail how to read the tables:

Paul Said	How Many Times	Times Right	Times Wrong	Percent Correct
.5	30	15	15	50
.6	10	6	4	60
.7	10	7	3	70
.75	20	15	5	75
.9	10	9	1	90
1.0	20	20	0	100
Totals	100	72	28	72%

Baruch Said	How Many Times	Times Right	Times Wrong	Percent Correct
.5	30	18	12	60
.6	10	8	2	80
.7	10	8	2	80
.75	20	13	7	65
.9	10	9	1	90
1.0	20	16	4	80
Totals	100	72	28	72%

The instructions continued:

> . . . [Paul] is perfectly calibrated, because his response is always equal to the percent correct. For exactly 70% of all the times he said ".7," he was right, and 30% of the time, he was wrong. He got half of his ".5" responses right, and all of his "1.0" responses right, and so on.
>
> . . . Baruch was not well calibrated. For only one class of his responses was he "right on": he did get exactly 90% of his ".9" responses correct. But otherwise, he

didn't use the probabilities the way he should have. Across the 30 times he said ".5" he got 60% of them right, instead of the desired 50%. This is a kind of underconfidence; he knew more than he thought he knew. At the other extreme, he was wrong too often when he said "1.0"--he got only 80% right (to be perfectly calibrated, you can never be wrong when you say "1.0"). This is overconfidence; he knew less than he thought he knew.

Notice that Paul and Baruch both got, overall, 72% of their answers correct. They both have the same degree of knowledge. But knowledge is independent of calibration. So don't worry about how much you know and don't know in this experiment--we don't care much about that.

Results

Mode of Analysis

Two-way analyses of variance (Instructions x Gender) were run on the following measures, calculated separately for each subject:

(1) Percentage of correct answers
(2) Mean probabilistic response
(3) Overconfidence: the signed difference between the mean response and the proportion correct. A positive difference indicates overconfidence; a negative difference, underconfidence.
(4) Calibration: The mean squared difference between each probabilistic response and the proportion correct within that response category, weighted by the number

of responses in each category. For perfect calibration, this measure would be zero. The largest calibration score we have ever observed over 200 items is .115. Since this measure is highly sensitive to the number of different responses used, all data were grouped into six response categories before calculating the measure. These were: .5-.59, .6-.69, . . . , .9-.99, and 1.0. For further discussion of this measure, see Lichtenstein and Fischhoff (1977).

(5) Proportion of times a subject responded "1.0."

(6) Percentage correct when responding "1.0."

The means of these measures are shown in Table 1.

Effect of Instructions

The instructions had no statistically significant effect on any measure. These results reinforce our suspicion that the unusually good calibration of some subjects in Lichtenstein and Fischhoff (1980) reflects something about those subjects rather than something about the (long) instructions they had received. Of the 71 subjects in the present experiment, only 6 had calibration scores of less than .010 (which we consider to be an upper bound for calling someone "pretty well calibrated"). The calibration curve (Figure 1) of all subjects combined shows overconfidence similar to that reported so often in past studies. It is typical of most of the present subjects, only five of whom were not overconfident.

Gender Differences

Males had a higher percentage correct (66 vs. 62) and gave higher probabilistic responses (.76 vs. .72) than did females.

Table 1

Means for All Performance Measures

		Long Instructions	Short Instructions	Combined
Percentage of correct answers	Male	65	67	66
	Female	62	62	62**
Mean probabilistic response	Male	.76	.77	.76
	Female	.74	.71	.72*
Overconfidence	Male	.10	.10	.10
	Female	.12	.08	.10
Calibration	Male	.031	.030	.031
	Female	.035	.028	.031
Proportion of "1.0" use	Male	.29	.34	.31
	Female	.25	.20	.22*
Percentage correct for "1.0" responses	Male	.83	.84	.84
	Female	.79	.82	.81**
Number of subjects	Male	20	14	34
	Female	18	19	37
			total	71

Note: There were no significant differences between long and short instructions. Significant gender differences are shown as: * $p < .01$
** $p < .001$

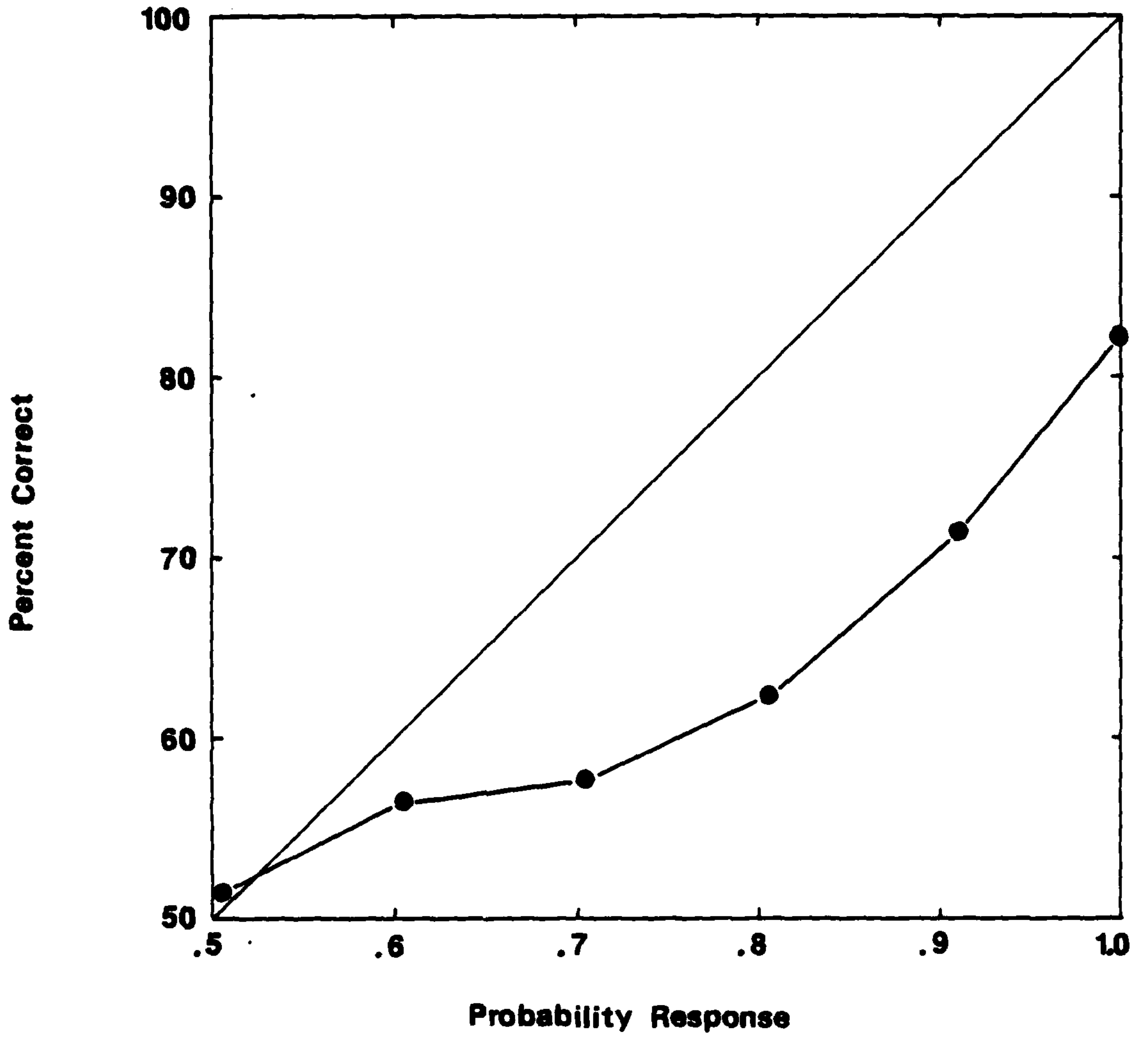

Figure 1. Calibration curve for all 71 subjects

That is, they knew 4% more of the answers to these particular general-knowledge questions and had, on the average, .04 more confidence in their answers. As a result, both genders were equally overconfident. They were also equally well (or poorly) calibrated, a result that is frequently, but not necessarily, associated with equivalent overconfidence. One reflection of males' greater confidence was a greater propensity to use "1.0" responses (31% vs. 22% of all responses). They were also correct slightly more often when saying "1.0" (84% vs. 81%), a result that seems to have no particular significance. Within each gender, those who used "1.0" more often tended to have <u>fewer</u> of those responses correct ($r = -.42$ for males and $-.50$ for females).

Discussion

Using long instructions with explicit explanations of calibration did nothing to challenge the well-documented conclusion that people are overconfident and poorly calibrated for general-knowledge questions of moderate difficulty. These results are also consistent with other results (reviewed by Fischhoff, in press) indicating that poor calibration is not due simply to a misunderstanding of the response scale. For example, Fischhoff, Slovic and Lichtenstein (1977) found overconfidence with odds assessments, as well as with the more usual probability responses. They also found (as we did here) that subjects chose the wrong alternative all too often when using the response of 1.0. Since people should know what it means to say "I'm sure," this response cannot be accused of ambiguity or unfamiliarity. In contrast, Koriat, Lichtenstein and Fischhoff (1980) were able to reduce overconfidence without any explanation of the response scale beyond the short instructions used here. They did so by asking their subjects to list one or more reasons why the answer they had chosen might be wrong. Thus, overconfidence in one's knowledge appears to be due more to cognitive difficulties than to unfamiliarity with probabilistic response modes.

Our finding that males know more answers to trivia questions than do females has also been reported by Nelson and Narens (1980). Using a recall task, they found that male college students more often produced the correct answer than did female college students for 86% of their 300 questions.

The slightly greater knowledge of our male subjects was paralleled by slightly greater confidence, leaving the two gender groups equally overconfident. Although there were no overall differences in calibration, males used the certainty response (1.0) somewhat more appropriately.

Finally, we found a hint of an individual difference which might be worth pursuing: within each gender group, the more often subjects used 1.0, the less often they were right on those assessments. This finding might be related to the modest ($r \doteq .30$) correlations reported by Hession and McCarthy (Note 1) and by Wright and Phillips (1976) between calibration and the Authoritarianism (F) Scale.

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1400 Wilson Blvd.
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Stanford University
Stanford, CA 94305

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1200 17th Street, N.W.
Washington, D. C. 20036 (3 cys)

Dr. Richard W. Pew
Information Sciences Div.
Bolt, Beranek & Newman, Inc.
50 Moulton Street
Cambridge, MA 02138

Dr. Hillel Einhorn
University of Chicago
Graduate School of Business
1101 East 58th Street
Chicago, Illinois 60637

Mr. Tim Gilbert
The MITRE Corp.
1820 Dolly Madison Blvd.
McLean, VA 22102

Dr. Douglas Towne
University of Southern California
Behavioral Technology Laboratory
3716 S. Hope Street
Los Angeles, CA 90007

Dr. John Payne
Duke University
Graduate School of Business Administration
Durham, NC 27706

Dr. Andrew P. Sage
University of Virginia
School of Engineering and Applied Science
Charlottesville, VA 22901

Dr. Leonard Adelman
Decisions and Designs, Inc.
8400 Westpark Drive, Suite 600
P. O. Box 907
McLean, Virginia 22101

Dr. Lola Lopes
Department of Psychology
University of Wisconsin
Madison, WI 53706

Mr. Joseph Wohl
The MITRE Corp.
P. O. Box 208
Bedford, MA 01730

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